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Bovine Dystocia*

BY

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FOR those of us who engage in country practice, especially in the dairying districts, the subject of bovine dystocia will always be a prominent one for it is likely in a practice of average size that we shall be called on to attend several hundred cases in a year. During recent years reproductive dysfunction has received great attention and an enormous literature has developed. In fact attempts to read it all, let alone understand it, leave one bemused. Most of this, however, has related to failure of conception and to the interruption of pregnancy and very little has been directed to the losses both to mother and offspring which result from abnormalities at parturition. What is the incidence of abnormal labour in dairy cattle under the conditions of health which may be reasonably expected to-day?

TABLE I

CALVING DATA

HERDS A, C, AND D. FROM OCTOBER, 1950 TO DECEMBER, 1957
HERD B FROM JANUARY, 1955 TO DECEMBER, 1957

	A Friesian		B Friesian		C Ayrshire		D Ayrshire		Total	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total calvings	436		119		788		754		2,097	
Assisted	36	8	14	11·7	22	2·7	23	3	95	4·5
Total calves born										
dead	23	5	9	7	25	3	51	7	108	5
Normal birth	17		6		19		47		89	4
Assisted birth	6		3		6		4		19	20
Total retained										
placenta	17	4	8	7	44	6	27	3	96	4·5
Normal birth	7		1		34		20		62	3
Assisted birth	4		5		4		4		17	18
Twin birth	6		2		6		3		17	43
Cases of twins	15	3·5	2	1·7	11	1·4	11	1·4	39	1·8
Maternal deaths	2		0		0		1		3	0·14

Table I gives the records of a group of farms with which we at Liverpool are closely associated throughout a period when they were, we believe, free from

*A Special University of London Lecture delivered at the Royal Veterinary College on February 28th, 1958.

infective diseases which interfere with reproduction. From this it will be seen that in 2,097 calvings, veterinary assistance was required in 95 (4·5 per cent.). I have qualified the word assistance for in all the herds the herdsmen are experienced and there will have been other cases in which parturition was prolonged in which relatively simple traction assistance was given by them. It will be noticed that the incidence of dystocia was significantly higher in the 2 Friesian than in the 2 Ayrshire herds (8.25 and 11·7 per cent., as opposed to 2·7 and 3 per cent.). In reviewing parturition records the inclination is to think in terms of the foetus only whereas expulsion of the foetal membranes is also an important part. The foetal membranes were retained for a period of 48 hours and upwards in a total of 96 cases (4·5 per cent.). If, however, those which were associated with protracted and assisted labour and with twin pregnancies are excluded, and the condition is related to normal expulsions only, the incidence becomes 3 per cent. It will be noticed that the condition was significantly higher in the Ayrshire than in the Friesian herds and in this connexion my colleagues who deal with routine parturition have observed that the incidence of dystocia from what appears to be solely uterine inertia is much higher in the Ayrshire than in the Friesian herds.

Insofar as twinning is concerned it will be noted that of the 39 cases quoted retention of the foetal membranes occurred in 17 (43 per cent.). This high incidence is a matter for thought. I am one who believes that in non-infective cases retention is due to inertia in the third stage but in the case of twinning one wonders whether the retention is related to the disposition of the foetuses in the uterus. My experience of abattoir *post-mortem* specimens is that about 50 per cent., of bovine twins are disposed unicornually and about 50 per cent., bicornually. It will be noted that the overall incidence of twinning was 1·8 per cent. In 3 of the herds the incidence was regular ; in the fourth it was significantly higher. It is of interest that the last is a pedigree Friesian herd of rather close breeding. It must of course be recognised that the incidence of twins born is not an accurate reflexion of the frequency of twin ovulation, for abattoir specimens come to hand in which there are 2 corpora lutea but only 1 foetus ; nevertheless, the proportion of such cases is small (about 15 per cent.) and I believe it is true to assume it to be highly probable that twin ovulation will be associated with twin conception. A further point is that while in the majority of instances of twin ovulation from a single ovary both foetuses develop in the cornu of the same side, in some one of the embryos migrates to the other cornu. It may well be asked, is it likely that any of the twins of the same sex were homozygous ? My belief is that identical twinning in cattle is extremely rare. At any rate in the many abattoir specimens I have examined over the years, I have not encountered a case of twinning with a single corpus luteum although I am aware that Dr. Arthur of this College has recorded such a case. Table II indicates the sex distribution of the twins dealt with.

TABLE II

BOVINE TWINNING
SEX DETAILS OF 40 CASES

♂♂		17
♀♀		7
♂♀		16
Total	Males —	50
,,	Females —	30

A further feature to which attention should be directed is the number of stillborn calves (by stillborn I imply calves which were alive up to the time of expulsion). It will be seen that the total number was 108 (5 per cent.) of which 89 were related to normal deliveries. This is largely an avoidable loss which lies in the field of animal husbandry rather than of veterinary surgery.

Reviewing this particular series of dystocia cases it will be seen that the most frequent cause was oversize of a normally presented foetus—55 per cent.,

TABLE III

ASSOCIATED FARMS.—ANALYSIS OF 95 DYSTOCIA CASES

Cause	A Friesian	B Friesian	C Ayrshire	D Ayrshire	Total
1. MATERNAL FACTORS					
Inertia	1	2	4	10	17
Cervix	3	—	—	—	3
Vagina and Vulva	1	1	—	1	3
2. FOETAL FACTORS					
Oversize : Anterior	20	6	11	5	42
Oversize : Posterior	5	3	2	1	11
Abnormal presentation, head	2	—	1	2	5
Fore-limbs	2	2	1	1	6
Hind-limbs	—	—	—	2	2
Abnormal position	—	—	1	1	2
Twins	2	—	1	—	3
Hydrops Foetus	—	—	1	—	1
Total	36 (436)	14 (119)	22 (788)	23 (754)	95

next was uterine inertia—17 per cent., while abnormalities of posture comprised 16 per cent. All except 3 of the animals were delivered *per vaginam* ; the exceptions were cases of failure of the cervix fully to dilate in which caesarean section was adopted. There were 3 maternal deaths ; one was due to previous uterine rupture due to lay interference (relative oversize in posterior presentation in which the tail was directed over the back), one due to milk fever complications (injury to the adductor muscles) and the third was one of incomplete dilatation of the cervix in which there was gross delay with the result that the foetus was putrid and emphysematous ; death followed caesarean section. It may well be asked, in what proportion of bovine dystocia cases is caesarean section the only interference likely to preserve the mother's life ? In the series already referred to it was 3 per cent. From discussions with practitioners who work in areas in which the Friesian breed predominates, I would put the figure at about 4 per cent. It will be significantly less in those areas in which the other dairy breeds are more numerous.

The review of a series of 200 caesarean sections performed in my department at Liverpool and attended at the request of practitioners practising over an area of up to 70 miles from the Field Station, gives a much broader picture of the causation of dystocia, but in this series also the Friesian breed predominates.

TABLE IV

REVIEW OF CAESAREAN SECTIONS
INDICATIONS FOR OPERATION

Indication	Series 1 100	Series 2 100
Maternal immaturity	9	8
Foetal oversize	16	21
Incomplete cervical dilatation ...	22	21
Schistosomum reflexa	19	18
Other monsters	5	2
Uterine torsion	13	17
Hydrops foetalis	5	2
,, allantois-amnii	4	—
Postural obstruction with fluid loss, emphysema	4	5
Transverse presentation	—	2
Resorbed mummies	3	1
Pelvic injury	—	2

In view of the recent discussion in the veterinary press regarding the general approach of the profession to protracted labour in the heifer and cow which arose from an article in which it was claimed that veterinary surgeons interfered far too early and that animals in labour might properly be left for 8 to 12 hours without interference (and in which, incidentally, unnamed writers of text-books on obstetrics came in for severe criticism), I propose to say something of the normal process of parturition and later attempt to produce evidence refuting this thesis. But first of all we must define what we mean by the term " in labour." In the human being and particularly primiparae, the progressively increasing uterine contractions which characterise the first stage of labour are felt and their significance is understood by the mother. They may persist for a period of 24 to 48 hours before the cervix is fully dilated and the foetus engages at the pelvic inlet. This is the waiting period. Not infrequently in the heifer the first stage is associated with detectable abdominal discomfort. Her appetite is intermittent, rumination is interrupted, she may look around at her abdomen, perhaps kick her belly, and may occasionally indulge in a straining effort. This may continue for a period of 24 hours or so. Examination *per vaginam* at this stage will reveal a partially dilated cervix, one that will probably admit the fingers cone-wise to the knuckles, still occupied by cervical mucin. Any interference at this stage would generally be wrong. In multiparae this stage is seldom recognised ; it would seem to be of much shorter duration and signless. But what is generally referred to as labour in cattle relates to the second stage ; the cervix has dilated to its full extent, its mucus is lost, the allantois-chorion has ruptured and the amnion with parts of the foetus has passed into the vagina, often to the lips of the vulva. The more bulky parts of the foetus engaging at the pelvic inlet provoke vigorous and repeated straining, a response which is irresistible. An interesting sidelight is that in certain forms of dystocia, particularly torsion of the uterus and to a lesser degree failure of the cervix fully to dilate, the farmer is often uncertain as to how long the animal has been in labour and statements such as the following appear in the case records—owner thinks she may have been calving for several days but was unable to make up his mind because of the absence of the usual pattern of straining. I believe that it is the absence of the engagement of the bulky parts of the foetus at the pelvic inlet and in the vagina which is responsible for this. But to return to the main thesis, the crux of the discussion is how long an animal should be left in the second stage of labour provided presentation is normal before it is proper to conclude that she is unable to deliver her calf unassisted. This is a matter of great significance particularly in the Friesian breed in which relative oversize of the foetus is very common. My experience has been that normal second stage labour, that is the whole process of expulsion of the calf, does not occupy longer than 4 hours and that in the great majority of cases it is very much shorter, and that if that time has elapsed without significant progress being made, assistance should immediately be considered (Richter & Götze put the maximum time in cows at 3 hours but state that in heifers it may occupy 5 or 6). Once dystocia exists the complications relating to delivery such as loss of the foetal fluids, swelling of the vagina and vulva, contraction of the uterus everywhere on the foetus and death of the foetus and uterine inertia, progressively develop. It has been suggested that many cases diagnosed as dystocia due to relative oversize of the foetus and to failure of the cervix fully to dilate are in fact errors on the part of impetuous veterinary surgeons. One would comment at once that we are very familiar with the foetus undergoing putrefactive emphysema *in utero* in which there is no abnormality of presentation or posture and in which there has been no interference whatever. It cannot be doubted that these have been given more than sufficient time. I find that in the series of caesarean section cases previously

XUM

quoted and to which I shall refer in more detail later, a diagnosis of oversize was made in 37 and of imperfect cervical dilatation in 43 (18·5 and 21·5 per cent., respectively). The initial diagnosis was made by the veterinary surgeon who referred the cases to the Field Station and I would comment that veterinary surgeons practising in the country areas of Cheshire, Shropshire and North Wales are not unfamiliar with calving cows. In the great majority of cases not less than 2 or 3 hours of second stage labour (often very much longer) had existed before the veterinary surgeon made his initial examination and to this must be added 2 to 6 hours before the animal arrived at the hospital, yet in none did she calve in the truck nor in fact had her parturition significantly advanced since she was first seen. But let us refer to the records of others and particularly foreign veterinary surgeons who have had different teachers and probably different text-books. Vandeplassche and Paredis in Belgium recording 150 caesarean sections quote oversize as the indication in 34 per cent., and incomplete dilatation in 25 per cent. Vrtěl in Czecho-Slovakia, quoting 65 cases, reports oversize in 23 per cent., and incomplete cervical dilatation in 40 per cent. Rasbech in Denmark, recording 68 cases, found absolute oversize in 8·8 per cent., but does not give the figure for relative oversize. He states, however, that prolonged vaginal interference with foetal emphysema was the indication in 19 per cent., and I think it likely that some of these were primarily due to oversize. Failure of the cervix properly to dilate was responsible for 16 per cent. Finally, to return to England, Messervy and his colleagues in their 54 caesarean cases gave the percentage for foetal oversize and failure of the cervix properly to dilate at 12 and 21 respectively.

But let us consider the welfare of the calf. Clearly this is related primarily to placental function and we must determine how long the placenta will continue to function adequately after the onset of second stage labour. Degeneration of the placenta has already commenced before the onset of parturition, in fact it is probably one of the most important factors which govern the onset of parturition, a by no means simple process but one dependent on the perfect functioning of a most complex hormonal mechanism. In the average uncomplicated bovine birth the foetal membranes are expelled some 5 to 6 hours after the expulsion of the calf, thus a total of 7 to 8 hours is normally occupied by the second and third stages together. My experience has been that the calf will continue to live for a period of 8 to 12 hours after the onset of second stage labour provided, of course, that some other factor such as compression of the umbilical cord within the maternal pelvis has not supervened. After this time the calf is dead consequent in part on continued degeneration of the placenta and more particularly to extensive separation of the foetal from the maternal cotyledons. This point is, I think, well exemplified by further examination of our caesarean section records.

From this it will be seen that of the cases in which the calf was living at the time of operation, in 1·6 per cent. only were the membranes removable at operation, whereas in those in which the calf was

TABLE V

BOVINE CAESAREAN SECTION
THE FOETAL MEMBRANES

State of foetus at operation	Number involved	Already detached or easily pulled away	Firmly attached but expelled naturally	Retained 24 hours —17 days
		per cent.	per cent.	per cent.
Alive	62	1·6	70	28
Dead	107	60	15	25

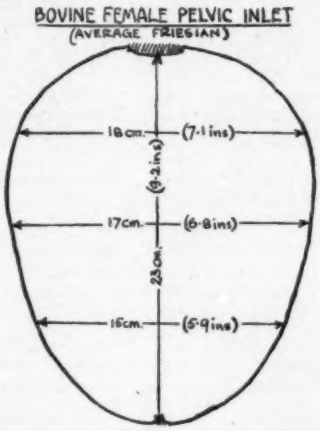
dead, in 60 per cent., the membranes were already completely detached or union was so slight that they were easily pulled away. A further point arising from these observations is that in early cases although the membranes were firmly adherent at operation, in 70 per cent., they were expelled naturally during the next 5 to 12 hours. I ascribe the high incidence of retention in both groups to inertia consequent on protracted labour.

I have postulated that if a healthy heifer or cow has been straining forcibly for 2 or 3 hours, that the amniotic sac is protruding from the vulva and may or may not have burst, that the foetus is engaged at the pelvic inlet and no more progress is made, then it is highly probable that parturition has become pathological and that without aid delivery will not occur. Maternal efforts will continue for some 8 to 12 hours but will become progressively less frequent and forceful until to all intents and purposes they cease. It is likely that the foetus will continue to live for some 8 to 12 hours provided it has not been severely damaged by interference or is severely impacted in the maternal pelvis. From this point the foetus and the membranes undergo progressive putrefaction, often with considerable gas formation, and progressive toxaemia of the mother occurs. How long is the mother likely to live ? My experience indicates 3 to 5 days, again with the proviso that she has not been seriously injured by interference.

Foetal Oversize

May I now develop in greater detail the subject of foetal oversize for it is one of great significance in the Friesian breed?, and in this connexion I am not referring to cases of exceptionally long gestation nor to physically immature mothers. In the uniparous species the dimensions of the foetus are closely related to those of the maternal pelvis through which it must pass. This relationship is such that for normal birth to occur it is necessary that when presented at the pelvic inlet the foetal trunk and appendages shall be disposed in an exact manner but provided they are so presented it is highly probable that physically mature heifers and cows will expel their calves unaided. This statement certainly holds true for the Channel Island breeds, the Ayrshire and the Shorthorn. In the Friesian breed a high proportion are unable to expel the calf naturally, despite presentation being normal, on account of the calf being too large to navigate the birth canal unaided. The points at which obstruction occurs are the occiput (the head lying on the elbows), the chest

with the superimposed scapulae and at the hips. The foetus may be in anterior or posterior presentation and according to the site of obstruction you will be able to visualise the extent of the parts occupying the vagina and vulva. In posterior presentation the base of the tail is a significant factor. The degree of oversize varies greatly ; in some it is relatively slight and the application of controlled traction serves to deliver the calf without significant injury either to itself or the mother. In other cases it is greater yet by the application of severe traction, especially mechanical traction, it is possible to withdraw the foetus but in so doing the mother is exposed to a grave risk of injury; tearing of her uterus, vagina or perineum. In some cases severe nerve damage may result, while in others there may be displacement of the sacrum. Finally, the degree of oversize may be such that it is impossible to extract the calf. In order to assess the proper procedure in an individual case it is necessary to know something of the range of the normal pelvic dimensions of cows and also something of the critical measurements of calves. You will remember that the bovine female pelvic inlet is irregularly oval in outline being longer in the sacro-pubic than in the transverse plane, and of the transverse being rather broader in the upper than the lower segment. Benesch gives the dimensions as from 22 to 24 cm. from above-below and from 16 to 18 cm., transversely. My own observations of normally developed Friesians confirms these figures but with a rather greater range ; sacro-pubic from 21 to 27 cm., and bisiliac 16 to 20 cm. In terms of inches the average represents 9½ by 7½, with a circumference of 28.



What is the average birthweight of calves of the different breeds ? Clearly any statement made must be based on a considerable number of observations and I have British and American figures in this connexion.

Table VI serves to demonstrate that Friesian and Holstein breeds have significantly larger calves than do the other dairy breeds quoted. What is the greatest weight of calf that the average sized adult Friesian may be expected to expel without assistance ? This is a matter of great variation because calves vary

TABLE VI
BIRTH-WEIGHT-CALVES
NORMAL GESTATIONAL PERIODS

Breed	Average of both Sexes in lb.	
	England*	U.S.A.†
Friesian	92	—
Holstein	—	89
Ayrshire	70	72
Dairy Shorthorn	79	73
Guernsey	—	71
Jersey	—	55

Males average about 5 per cent. more than females.
*N.I.R.D. Reading. † Eckles and Anthony

not only in weight but in conformation. I would put the average figure at 95 lb. I acknowledge that there are exceptional cases in which considerably heavier calves are born naturally but conversely there are smaller ones associated with dystocia. Next, one must ask up to what weight is it reasonable, after the induction of epidural anaesthesia, to apply traction without subjecting the mother to a risk of severe injury and in this connexion I am referring to the recent case in which the amnion and the surface of the calf's body are moist and glistening. The degree of traction I have in mind is the pulling effort of four men (as a digression I would commend to you the value of episiotomy when the vulva causes difficulty). In the average animal I would put this at 105 lb. On no account must we jump to the performance of caesarean section too quickly. If by skilful manipulation and careful judgment it is possible to deliver the animal *per vaginam* without significant injury then it is always our duty to do so. But equally so in those cases in which it is impossible safely to deliver her in this way the sooner the fact is recognised the better, for nothing exhausts the animal more quickly than futile efforts to effect vaginal delivery. How can one accurately assess the likely size of the calf when the only parts available for inspection or palpation are the limbs, the face and head or the hip region ? I have paid some attention to the dimensions of calves at birth with the hope that some correlation might be found between parts which were measurable during the process of calving such as the digit, the fetlock, carpus or tarsus, and the foetal weight and size. I have been disappointed. There is such great variation in the conformation of calves which, incidentally, is irrespective of sex. Some which have stout limbs are of normal size and weight ; others which are grossly oversized may have quite slender limbs. This is illustrated by Table VII.

Gross overweight is generally related to excessive muscular development. It will be noticed that the skeletal measurements of the 146 lb. calf differ only slightly from those of the 86 lb. one. The muscular development of the former was enormous ; the measurement around its hips and thighs with its legs extended backwards being 35 inches, and around its shoulders with its fore-limbs fully extended 33¼ inches. The circumference of the maternal pelvic inlet in this case which was subsequently measured was 28 inches.

TABLE VII

DIMENSIONS OF NEWLY-BORN CALVES (FRIESIAN)

Weight lb.	Sex	Circumference					Width	Length
		Fetlock	Cannon	Carpus	Chest	Head at eyes	Hips	Occiput-tail base
		inches	inches	inches	inches	inches	inches	inches
71	♀	6¾	4¼	7¾	26	16	7¼	30
82	♂	7¼	4¾	9	33	18½	7½	31½
85	♀	6¾	4	7¾	29	19	8¼	33
86	♂	7¾	5	8¼	30¼	19	8¼	34¼
89	♂	7¼	4¾	8	30½	17¾	7½	35¼
92	♂	7¼	5	8¼	31	18½	7¾	34
112	♀	7	4¾	7¾	32	19¾	8	37
112	♂	7¾	5¼	9¼	35¼	19½	8¾	34¼
113	♂	8	5¼	9½	33½	—	8¾	—
117	♂	7½	5¼	—	39	—	8	41
120	♂	7¾	5	—	—	20	9	—
146	♂	7¾	5	8	31	20¼	9	35

The calf, which had been subjected to severe mechanical traction, was acutely impacted at the shoulders and maternal bilateral obturator paralysis ensued which ultimately necessitated her destruction.

Thus I can only repeat that when it becomes obvious that no headway is being made on the application of traction properly applied by four men, then it should be concluded that the oversize is absolute and caesarean section adopted.

Case Protocols Illustrating Oversize of the Foetus

No. 3899 (11.8.54). A 2-year-old Friesian heifer, well grown. Had been in second stage labour for about 4 hours. Posterior presentation, wedged at hips. Had been subjected to severe mechanical traction before arrival. She had been dragged into the wagon and had to be dragged out of it. The heifer was exhausted. Caesarean section was performed under general anaesthesia and a dead male calf weighing 124 lb., removed. The membranes were expelled 5 days later. Although the heifer made an excellent recovery from operation, she was unable to rise and was destroyed on the 12th day. *Post-mortem* examination showed gross tearing of the adductor muscles.

No. 3914 (27.8.54). A 3-year-old Friesian heifer in poor condition. She had been in second stage labour for about 24 hours; oversize in anterior presentation with impaction at the shoulders. Severe traction had been applied and embryotomy of the head and both fore-limbs performed. She was recumbent on arrival and was unable or unwilling to rise; exhausted. The remains of the foetus were removed by caesarean section under general anaesthesia. The membranes came away with the foetus. The heifer made a relatively smooth recovery and was in hospital 18 days; the daily milk yield on discharge being 33 lb. This animal has since conceived, and calved without assistance.

No. 4562 (4.5.56). A 2½-year-old Friesian heifer in second stage labour of about 5 hours duration. Oversize of the calf in posterior presentation. The foetal hips were firmly wedged. Caesarean section was performed under general anaesthesia. Considerable force *per vaginam* was necessary to disengage the foetus before it could be removed from the uterus. A living male calf of 104 lb. was delivered which survived. The membranes were retained for 3 days, otherwise recovery was uninterrupted. She was in hospital 7 days and has since calved without assistance.

No. 4595 (31.5.56). A 2½-year-old Friesian heifer which had been in second stage labour for about 4 hours. The case was one of oversize in anterior presentation wedged at the chest, with the digits at the vulva. Caesarean section was performed under general anaesthesia; a dead male calf weighing 120 lb., was removed. She cleansed 2 hours later. Recovery was uninterrupted. She was in hospital 13 days and her yield on discharge was 40 lb. She has since calved normally.

No. 4709 (18.9.56). A 2½-year-old Friesian heifer which had been in labour 6 hours. Forced traction had been applied and the head and a fore-limb removed. The cause of dystocia was oversize with impaction at the shoulders. The heifer was recumbent on arrival, unable to rise and distressed. Caesarean section was performed under general anaesthesia. The remains of the male calf weighed 99 lb. The membranes were expelled naturally. Left obturator paralysis persisted for 3 days; otherwise she made a good recovery. In hospital for 14 days. The animal failed to conceive subsequently.

No. 4892 (7.2.57). A Friesian cow; second calf. Had been in forceful labour for about 8 hours; oversize in anterior presentation. Block and tackle traction had been applied and embryotomy of the head performed. The shoulders were impacted. She was recumbent on arrival and very exhausted. Caesarean section was performed under general anaesthesia. Removal of the calf from the uterus was very difficult owing to the complete loss of foetal fluids and the impaction of the calf. A male calf weighing 134 lb. (without head) was delivered. She cleansed normally 5 hours after operation and made a surprisingly good recovery from operation but was unable to rise due to nerve damage and was destroyed on the 20th day.

You are aware that on the Continent, total embryotomy, by which is meant division of the calf in both the transverse and longitudinal planes, has been extensively employed in the treatment of oversize of the foetus. My own view is that while embryotomy has an important place in bovine obstetrics its value lies chiefly in the removal of appendages. Attempts at total embryotomy will frequently fail; they are most exhausting both for the patient and operator. Caesarean section gives a more favourable prognosis.

In the Leahurst series the average weight of the calf diagnosed as oversize was 112 lb., range 86 to 146.

Failure of the Cervix Fully to Dilate

The cause of this condition is unknown but that it frequently causes fatal dystocia in cattle is undoubted. It represents one of the commonest indications for caesarean section. In the past it has been ascribed chiefly to fibrosis of the cervix consequent on injury at a previous parturition but in our experience it is as frequent in primigravida as in multigravida. Our impression is that it is more common in the Friesian than the Ayrshire breed. In the bovine species,

relaxation and dilatation of the exceptionally dense uterine cervix must be a quite positive matter ; it cannot be ascribed solely to the hydraulic pressure exerted by the foetal sacs and I can only conclude that failure of effective dilatation is due to hormonal dysfunction. It is of interest that several multigravida on which operation has been performed for this reason have subsequently calved normally. I have previously stated that care must be taken to distinguish between the first and second stages of labour and it may be difficult in an early case to determine that cervical dilatation has attained its maximum. This becomes the more difficult because straining is often insignificant and for this reason cases are often grossly protracted when first attended. My own practice is to advise caesarean section in cases of partially cervix in which the amniotic sac has been at the vulva for 4 hours or longer and parts of the foetus occupy the cervix. The condition is best illustrated by a few case records.

Protocols of Cases of Failure of the Cervix Fully to Dilate

No. 3820 (23.5.54). A Friesian heifer. The duration of labour was unknown but she was due 2 days previously. She had not been seen straining but the amnion was seen hanging from the vulva 8 hours ago. The cervix admitted 3 fingers and was occupied by the foetal digits. Caesarean section was performed under general anaesthesia and a dead male calf weighing 86 lb. removed. The membranes were already detached. Recovery was uneventful. She was in hospital 9 days and her yield on discharge was 35 lb.

No. 3972 (31.10.54). A Friesian heifer. She had probably been calving 2 or 3 days but owner was uncertain. The cervix was incompletely dilated and occupied by a single limb. The membranes had ruptured and the fluids were fetid. The heifer was severely ill ; dull, temperature 103·2, pulse rate 130. Prognosis grave. Caesarean section was performed under general anaesthesia. The uterus was distended by gas and a putrid foetus and membranes were removed. The endometrium was dark green in colour. The heifer recovered consciousness but died 9 hours later.

No. 4012 (26.11.54). A Friesian heifer. She was noticed to be straining slightly 2 days ago but this quickly passed off. The cervix admitted 3 fingers but contained no foetal parts. The membranes had ruptured and the fluid in the vagina was fetid. Caesarean section was performed under general anaesthesia. A dead and putrid bull calf weighing 105 lb. was removed with its membranes. The heifer made good progress but some wound infection developed. She was in hospital for 18 days ; yield on discharge 23 lb.

No. 4228 (6.7.55). A 5-year-old Friesian cow ; 4 days overdue with her third calf. The cowman believed she had been in labour about 12 hours but was uncertain owing to the slightness of straining. The cervix was only partially dilated and was tightly occupied by the calf's nose and fore-limbs. Caesarean section was performed under general anaesthesia. The calf was alive but was " dopey " for 48 hours ; it survived. The membranes were expelled 7 hours after operation. The cow made an uninterrupted recovery and was in hospital for 6 days ; yield on discharge 44 lb.

No. 4371 (10.11.55). A 3-year-old Friesian cow ; believed to have commenced calving her second calf yesterday but no vigorous straining had occurred. The membranes were seen and ruptured this morning. On arrival at hospital the cervix admitted 2 fingers only and was occupied by amnion. Caesarean section was performed under general anaesthesia and a live calf weighing 107 lb. was removed. Great difficulty was experienced in suturing the uterus and thus manipulation was excessive. The membranes were expelled naturally. The cow made an uninterrupted recovery and was discharged on the 11th day when her yield was 40 lb. She subsequently conceived and calved without assistance.

No. 4728 (8.10.56). A 2½-year-old Friesian heifer, believed to have been calving for 2 days. There was uncertainty. The membranes had appeared at the vulva and ruptured. The heifer was very dull. The cervix was only partly dilated and occupied by hind digits. Caesarean section was commenced under general anaesthesia. The uterus was found to contain a large volume of putrid fluid and the calf was enormous due to emphysema ; the uterine cotyledons appeared all to have sloughed. Operation was abandoned and the heifer destroyed.

Uterine Torsion

Among our findings in regard to bovine uterine torsion are the following points :—

1. The twist may occur to either side. It has been observed more often to the left but the numbers involved are too small to draw any conclusion from this.

2. The degree of twist varies from 90° to 180°, the latter being more common in cows than heifers.

3. The cervix is found to be either partially or fully dilated, more often the latter.

4. Cases are met during every month of the year and there is no significant difference in incidence in animals either at pasture or housed ; the monthly average from November to March was 1·2 and from April to October 1·57.

5. There is no significant difference in breed incidence so far as the Friesian, Ayrshire and Shorthorn breeds are concerned.

Superficially it would appear to be more common in multigravida than in primigravida, in fact in this series 4 cases were encountered in cows to every one in the heifer, but this is more likely accounted for by the preponderance of cows in the cattle population.

The impression is gained that torsion is more frequent when the calf is exceptionally heavy, and while our observations are incomplete, it is of interest that the average calf weight was 107 lb., with a range of 85 to 128.

Many and varied explanations have been advanced for uterine torsion. It cannot be doubted that the disposition of the heavily gravid uterine cornu and the site of attachment of the broad ligament predispose to torsion, but it is the exciting cause which arouses greater interest. It would seem to me almost certain that the condition occurs during the first stage of labour, at the time the cervix is dilating prior to the expulsive second stage, for it is inconceivable that the cervix would undergo any dilatation if a 180° twist had occurred at the uterine isthmus prior to the onset of natural dilatation. Moreover, the first stage is associated with particularly vigorous calf movement. Again, in cases of partial (90°) twist it is generally found that parts of the extended limbs of the foetus have passed through the cervix. The fact that the 180° twist is more common in cows than in heifers is probably explained by the greater volume of the abdomen in the former. It would seem that the accepted practices of rolling the mother, vigorously pommelling her abdomen or suspending her hind parts are more likely to be successful in partial cases. It may be significant that of those cases referred to us for caesarean section and which have failed to respond to one or other of these treatments, the majority are of the 180° variety. Torsion of the uterus is another condition in which the course of labour is often atypical, straining being absent or

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only slight. But in this connexion also one is exposed to the charge that one is in too much of a hurry in diagnosing that parturition is overdue. I can only reply that in 30 cases of irreducible torsion referred to us at Liverpool the calf was dead at the time of operation in 75 per cent., in some it was putrid. I regret I cannot give you any figures as to the proportion of torsion cases which respond to the simple forms of treatment but I can say that there are many which do not and thus the condition forms a very serious form of bovine dystocia. In the Liverpool series of caesarean section cases it comprised 15 per cent. of all indications; Vandeplassche quotes 24 per cent., Rasbech 26.5 per cent., Vrtěl 13·8 per cent., and Messervy and his colleagues 11 per cent.

Illustrative Case Protocols of Irreducible Uterine Torsion

No. 3244 (11.9.53). A Friesian cow of medium size with her second calf. The history was atypical; she had been kicking her belly for a week but there had been no sign of straining. The udder was distended with milk. Torsion. Three fingers could be pushed into the twist beyond which the digits could be felt. Caesarean section was performed under chloral hydrate-pentobarbitone sodium anaesthesia and a dead male foetus (94 lb.) which was in posterior presentation and oedematous about the head and neck, was removed. After suturing the uterus the twist which was of 180 degrees and anti-clockwise was corrected. The membranes were firmly adherent. Operation was fairly straightforward and occupied 1 hour. The membranes were expelled on the 4th day but a medium degree metritis developed. The animal made a good recovery; the wound healed by first intention. She was discharged after 19 days with a yield of 32½ lb., but she failed to conceive to subsequent services.

No. 3454 (28.10.53). An Ayrshire heifer with an atypical history. She was seen to be kicking her belly yesterday morning and had been very restless since but there had been no forceful straining. The veterinary surgeon had diagnosed torsion and had rolled the heifer without success. When admitted the amnion was hanging to the hocks. The vulva and vagina were swollen and oedematous and vaginal examination was difficult. The twist admitted 3 fingers and the nose of the calf was felt beyond. Caesarean section was performed under general anaesthesia. An attempt was made to correct the torsion before incising the uterus but was unsuccessful. Incision was undoubtedly made into the (true) dorsal surface of the uterus for the calf was removed by the head; a dead male weighing 95 lb. Excessive abdominal manipulation occurred both in removing the calf and in suturing the uterus. About half the membranes came away at operation; the remainder were retained for 10 days. The early post-operative course was good; metritis was treated with antibiotics, but wound sepsis developed and it became necessary to open the skin wound and, in part, the muscle wound. Slow healing occurred by granulation. She was in hospital 51 days. Yield 22½ lb.

No. 4474 (14.2.56). An aged non-attested Shorthorn cow; emaciated. An atypical history of calving for several days. The veterinary surgeon had diagnosed torsion. Caesarean section was performed in the standing position; chloral hydrate sedation, paravertebral block—3 per cent xylotox. The uterus was gravid with twins in a single horn; total foetal weight 100 lb. The foetuses were dead and putrid; membranes detached. The cow died 3 days later. *Post-mortem* examination revealed widespread tuberculosis. The peritoneum appeared healthy. The uterus, still in a state of 180 degree torsion, had undergone little or no involution and was occupied by a large volume of fetid fluid. Death was ascribed to toxaemia superimposed on general weakness.

No. 4764 (5.11.56). A Friesian heifer, thought by the farmer to have been calving for at least 48 hours but no forceful straining had been seen. Torsion was diagnosed. Rolling had been unsuccessful. Two fingers could be passed through the twist. Caesarean section was performed under general anaesthesia. After removing an 83 lb. living heifer calf, the torsion, about 90 degrees and clockwise, was corrected. The membranes were retained for 9 days. Heifer and calf made uninterrupted progress and were discharged on the 11th day. The heifer subsequently conceived to the first service and calved unaided in November, 1957.

Foetal Monsters

The incidence of monster development is high in the dairy cow, in fact 22 per cent. of our caesarean cases are related to this cause. Among the types encountered are muscle contracture monsters, double monsters and achondroplastic monsters; but these represent a small proportion only (3 per cent.) and the great majority is that classical bovine deformity—schistosomum reflexa. The pattern of abnormality is relatively constant. There is acute dorsal angulation of the vertebral column in the lumbar region with the result that the pelvic and shoulder girdles are close together with all four limbs extending in the same direction as the head. Sometimes one or more limbs are in a state of muscle contracture and ill-developed. The thorax fails to close about the sternum and the thoracic and abdominal viscera are either free or enclosed in a serous sac. One striking variation was met in a Guernsey in which the head and limbs were enclosed in a complete but inverted cutaneous sac.

As to whether the condition is hereditary or is related to some unfavourable uterine factor in the early life of the embryo, is unknown. It is certainly widespread among the British breeds of cattle for we have ourselves met it in the Shorthorn, Friesian, Ayrshire and Guernsey and in crosses with Hereford and Galloway. Of the cases referred to us for caesarean section, this monster has been the indication in 45 per cent. of the Shorthorns, 14 per cent. of the Friesians, and 8 per cent. of the Ayrshires. In this series the condition has occurred both in primigravida and in multigravida in a proportion of 1 : 2, and it would seem to involve male and female foetuses in about equal numbers. As to the manner of presentation of the monster at the maternal pelvic inlet, both limb and visceral presentations occur but the former is the more common. As a rule the monster is ill-developed and its weight is well below the average of new-born calves of the breed.

The veterinary surgeon is generally called to these cases with little delay or interference. Pelvic engagement is severe and hence there is marked straining while the average farmer is disinclined to interfere when the vaginal findings are so complex. It must be appreciated that in some instances it will be possible to deliver the monster *per vaginam* after suitable embryotomy, especially the small one in the roomy cow which is presented by its visceral extremity.

Case Protocols Illustrating Schistosomum Reflexa

No. 4333 (9.10.55). A Friesian cow; had been straining for about 6 hours. Epidural anaesthesia had been given to control straining and this had caused partial paralysis of the hind limbs. The cow was down in the truck on arrival and had to be dragged to the operating bed. The foetal head and three limbs were palpated in the vagina. Caesarean section. Induction anaesthetic—chloral hydrate; continuation with pentobarbitone sodium. A right ventral abdominal incision, 12 inches long, was employed. Operation was prolonged with

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excessive intra-abdominal manipulation. Rotation and extraction of the calf was very difficult. A female monster weighing 96 lb. and alive was removed. The membranes were expelled naturally. The cow made an uninterrupted recovery and was discharged from hospital on the 10th day. She has since calved normally.

No. 4500 (3.3.56). A 5-year-old Friesian cow. Had been straining for about 10 hours. She was still straining severely on arrival and so epidural anaesthesia was induced. Vaginal examination revealed head and one limb well advanced in the vagina with 3 other limbs at the pelvic inlet. Caesarean section was performed under chloral hydrate anaesthesia using a high left flank incision. Difficulty was experienced in manipulating the monster within the uterus. Its viscera were removed to give space followed by removal of the head to facilitate manipulation of the limbs. Prolonged intra-abdominal trauma was necessary. A male monster which weighed 78 lb. The membranes expelled normally 8 hours after operation. The cow made an excellent recovery and was discharged from hospital on the 12th day when her yield was 32 lb.; she subsequently conceived and calved normally.

No. 4685 (25.8.56). A Shorthorn cow with her third calf. The duration of labour was uncertain, but probably about 24 hours. A big, strong cow. A Schistosome in limb presentation. Caesarean section was performed under chloral hydrate supplemented by pentobarbitone sodium. Profuse ruminal regurgitation occurred. The uterus was opened within the abdomen and withdrawal of the monster caused gross uterine tearing. Uterine suture was difficult and incomplete and caused a great deal of trauma. A 60 lb. monster; membranes removed with it.

This operation was performed on the farm, some 25 miles from the Field Station, owing to Foot-and-Mouth disease movement restrictions. Report 17 days later—cow has done excellently. This cow subsequently calved normally on 9.9.57.

Generalised Foetal Oedema

Foetal anasarca is most often met in the Ayrshire breed in which it is one of the commonest causes of dystocia, but it also occurs in other breeds and this series includes the condition in the Friesian and Guernsey. In the majority of instances in Ayrshires it is possible after multiple incision of the foetus and possibly its evisceration to withdraw it *via* the vagina. Nevertheless, in some cases enlargement is so gross that vaginal delivery is impossible. Two case records well illustrate this:

No. 4082 (14.2.55). A Friesian cow which had been in labour for 12 to 14 hours. When seen by the veterinary surgeon the oedematous head was protruding from the vulva and was amputated in order to reach the limbs. On arrival at the hospital the trunk was tightly impacted in the pelvis. Caesarean section was performed under general anaesthesia. There was gross anasarca and ascites and it was necessary freely to incise the calf's abdomen and allow the fluid to escape before it could be withdrawn. It was estimated that about 1¼ gallons of ascitic fluid was released. The weight of the calf remains was 108 lb. The cow died 48 hours after operation from shock and peritonitis. The membranes were retained.

No. 4825 (24.12.56). A 6-year-old Ayrshire cow in labour for about 6 hours. Anterior presentation with oedematous head and fore-limbs impacted in the pelvis. Caesarean section performed under general anaesthesia using a high, left flank incision. The foetus was grossly enlarged and despite free incision to expel fluid it was necessary to enlarge the incision in the mother's abdominal wall to 17 in. before it could be removed; a male weighing 150 lb. The membranes were retained for 48 hours. The cow made an uninterrupted recovery, the wound healing *per primum*. She was in hospital 12 days and her yield on discharge 25 lb.

I do not propose to refer to that gross hydrops amnion-allantois which is a feature of pregnancy. My colleague, P. A. Neal, has recently reviewed the literature on the subject and his results of a two-phase operation in its treatment; (*a*) slow drainage, and (*b*) caesarean section.

Dystocia Due to Postural Abnormalities

You may be surprised that I have not referred to this aspect of bovine dystocia earlier. I have several reasons for this. In my experience it is not as frequent or as serious a cause of dystocia as those I have previously referred to. Moreover, its treatment both by manipulative and embryotomical means has been well and fully described in the text books. The introduction of epidural anaesthesia by Benesch has been a great facility. As a rule caesarean section is only necessary in delayed cases in which complicating factors have arisen; loss of the foetal fluids and contraction of the uterus everywhere about the foetal body; gross swelling of the vulva and vagina which restricts manipulation; gross enlargement of the foetus due to putrefactive emphysema. I would, however, again emphasise the, to me fundamental, point that when an animal has been in forceful second stage labour for several hours and no progress is made, it is essential that she shall be examined and if necessary the appropriate treatment immediately forthcoming.

Caesarean Section in the Treatment of Dystocia

Tables VIII, IX, X, XI and XII indicate the results obtained in the series of cases already referred to, but in speaking of caesarean section, I do not propose to refer to the technicalities of operation and after treatment. These have frequently been described; there are no tricks about them, they are well within the scope of a surgical team of average competence, and thus it is reasonable to expect that the results obtained will be the same or better than those quoted here.

What I do wish is to say something of the place the operation has in our agricultural economy under the existing practitioner-client relationship, for this is one of the subjects which exemplifies the great contrast which exists between the practice of human medicine and of veterinary surgery. Clearly the cost of work such as this must be correlated to the prognosis; first, the immediate result in relation to the life of the mother and calf; second, and even more important, the subsequent production expectancy of the mother.

The market value of a cow or heifer is based on the number and volumes of the lactations which may reasonably be expected from her. Basically it relates to her potential yield in a single lactation; it being assumed that she is capable of 5 or 6 such lactations.

These records show that between 80 and 90 per cent. of the mothers will make an apparent recovery. If the recovery has been rapid and uncomplicated it is likely that the subsequent yield will be the normal expectancy. If, however, she has had a stormy convalescence, it is unlikely that her yield will be satisfactory and it may be more profitable to fatten her. The value of a fat cow is not that of a dairy cow.

TABLE VIII

CAESAREAN SECTION
REVIEW OF TWO SERIES EACH OF 100
Series 1 Attended March 1949 to May 1955
Series 2 Attended June 1955 to December 1957

SUMMARY OF RESULTS

	Series 1	Series 2
Maternal recovery	72	90
„ death or destruction ...	28	10
Calves (normal) alive at operation ...	24	22
Survived	20	17

TABLE IX

MATERNAL RECOVERY RELATIVE TO LABOUR DURATION

Operation after labour of	No. dealt with and per cent. recovery	
	Series 1	Series 2
0—12 hours*	48—85 per cent	55—96 per cent.
12—24 hours	33—66 „	28—93 „
24 hours and over	19—47 „	17—65 „

*In 16 operation preparturient.

TABLE X

ANIMALS INVOLVED
PARITY AND BREED

	Series 1	Series 2
Heifers	55	49
Cows	45	51
Friesian	56	72
Ayrshire	23	14
Shorthorn	15	6
Others	6	8

TABLE XI

MATERNAL FERTILITY AFTER OPERATION

	Series 1	Series 2
Conceived and carried to term ...	12	12
Failed to " hold "	12	12

As to which of these patterns an individual case will follow will relate chiefly to the time after the onset of second stage labour at which operation is performed and this is generally outside the control of the veterinary surgeon, but taking the subject by and large I would say that in about 60 per cent. of cases the subsequent yield will be normal.

But there is another aspect to be considered : in what proportion of recovered caesarean cases does the animal retain her fertility ? Our records indicate 50 per cent. and I think it unlikely, having regard to the conditions under which we practise, that this proportion will significantly increase. Thus her value becomes further reduced ; nevertheless, there must be set against this her value as beef at the end of the lactation.

TABLE XII

CAUSES OF MATERNAL DEATH

	Series 1	Series 2
1. DURING THE 24 HOURS AFTER OPERATION		
(*a*) Shock	5	1
(*b*) Gross toxaemia and shock ...	5	2
(*c*) Technical failures	4	—
2. DURING THE PERIOD 2—20 DAYS		
Generalised peritonitis	9	4
3. DELAYED DEATHS OR DESTRUCTION		
(*a*) Peritonitis from wound infection	1	1
(*b*) Hernia...	2	—
(*c*) Paralysis due to injury before operation	1	1
(*d*) Operation abandoned as hopeless	1	1
	28	10

As to the fate of the calf : this is another matter largely beyond our control for in the majority of cases the calf is already dead. Of the normal calves which were alive when removed from the uterus, 80 per cent. have survived.

A further point is that the cost of the partial failure, and often of the failure, is greater than that of the fully successful case. At the same time we may remind ourselves that without operation her value is negligible. The rewards we shall receive will be related to all these factors. How this contrasts with a medical service the sole purpose of which is the saving of life and in regard to which nothing need be spared !

In closing, I wish to state that the records I have quoted represent the work of a clinical team of which I am but one. I would gratefully acknowledge the help and loyal collaboration of my colleagues, P. J. N. Pinsent, P. A. Neal and H. E. Ritchie.

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A Brief Review of Blood Coagulation and Methods for the Control of Haemorrhage

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SUMMARY.—1. *A general account is given of the normal mechanism of coagulation of blood.*

2. *A brief account is given of the principal drugs and agents which have been employed for haemostatic purposes and it is concluded that there is no therapeutic method available for producing hypercoagulability of the circulating blood of normal animals.*

3. *Local haemorrhage can be controlled effectively with absorbable sponge dressings preferably impregnated with such haemostatic agents as Russell's Viper Venom or Thrombin Topical, and applied with suitable pressure.*

4. *In certain pathological states involving disorders of fat metabolism, a tendency to a haemorrhagic diathesis can be antagonised by vitamin K therapy.*

5. *Vitamin K_1* (not *vitamin K analogue, water-soluble*) *is indicated for the treatment of the hypoprothrombinaemia produced by Warfarin poisoning.*

Introduction

HAEMORRHAGE, of whatever kind, has always been of great concern to both veterinary surgeons and physicians. Numberless patients have been lost from haemorrhage and efforts to prevent this have led to most diverse procedures. Many agents have been used in an attempt to produce hypercoagulable circulating blood, but none has so far been produced which has been uniformly successful in normal animals.

Haemorrhages can be classified in different ways, but for convenience in discussion they fall into 4 principal types:—

(i) *External haemorrhage* from wounds of skin and superficial tissues generally involving the blood vessels of skin, fibrous tissue, fascia, and muscular structures.

(ii) *Internal haemorrhage* from glandular or other organs, where the bleeding occurs into the cavities of the hollow viscera or into one or other body cavity. The blood may escape to the outside from hollow viscera (rectum, uterus, urinary bladder), but not from a body cavity.

(iii) *Tissue haemorrhage*, often the result of impaction trauma, where the skin or the capsule of an organ remains intact, and the blood infiltrates the inter-cellular spaces, or the subcutaneous or subcapsular structures.

(iv) *Spontaneous haemorrhage*, from such diverse causes as rupture of a blood vessel, violent changes in blood pressure, either locally or generally. Into this group fall epistaxis, pulmonary haemorrhage, and cerebral haemorrhage.

For the purposes of this article, the differences between arterial, venous, and capillary haemorrhage are not important, though under practical conditions they must usually be treated differently.

External haemorrhage presents no diagnostic problem, but the other 3 types may be hard to determine unless they are so severe that symptoms of acute blood loss are shown by the pallor of visible mucous membranes and by changes in heart action and the character of the pulse. These serious symptoms develop usually only after blood loss has been severe, and are often terminal. Further, unless internal types of haemorrhage can be diagnosed with precision, *e.g.* where blood escapes to the outside, they may be unsuspected until too late. It is in cases of internal, tissue, or spontaneous haemorrhage that a reliable therapeutic agent which would influence positively the speed and effectiveness of blood coagulation, would be most valuable. If it had no adverse sequelae, it would be logical to use it in all cases of suspected haemorrhage of these types, and doubtless a number of lives might thereby be saved.

To appreciate the complexity of the problem, a brief account of modern knowledge of the process of blood coagulation is desirable.

The Normal Blood Coagulation Mechanism

There are 3 stages in the formation of a coagulum from circulating blood requiring some nine separately recognisable agents, all of which must be present for a clot to be formed. Reference to Fig. 1 will help to make the mechanism clear.

After contact with a foreign surface (that is, other than vascular endothelium) there is a reaction between the blood platelets, anti-haemophilic globulin, Christmas factor, and factors V, VII, and X in the presence of calcium ions, to form blood thromboplastin. The process takes about 3 to 5 minutes. This newly-formed thromboplastin reacts very rapidly with the prothrombin of blood plasma, again only in the presence of calcium ions, to form thrombin. Thrombin acts with the fibrinogen in blood to form the insoluble fibrin which is the basic solid of a blood clot, no reagents beyond thrombin and fibrinogen being necessary. Both the thromboplastin to thrombin and the thrombin to fibrin reactions are very rapid, only about two or three seconds being required for each.

By the application of modern techniques it is possible to measure the formation of thromboplastin within blood specimens in the laboratory. Further, it is possible to investigate thrombin generation, and the emergence of a fibrin clot in a test tube

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A SIMPLIFIED SCHEME OF BLOOD COAGULATION

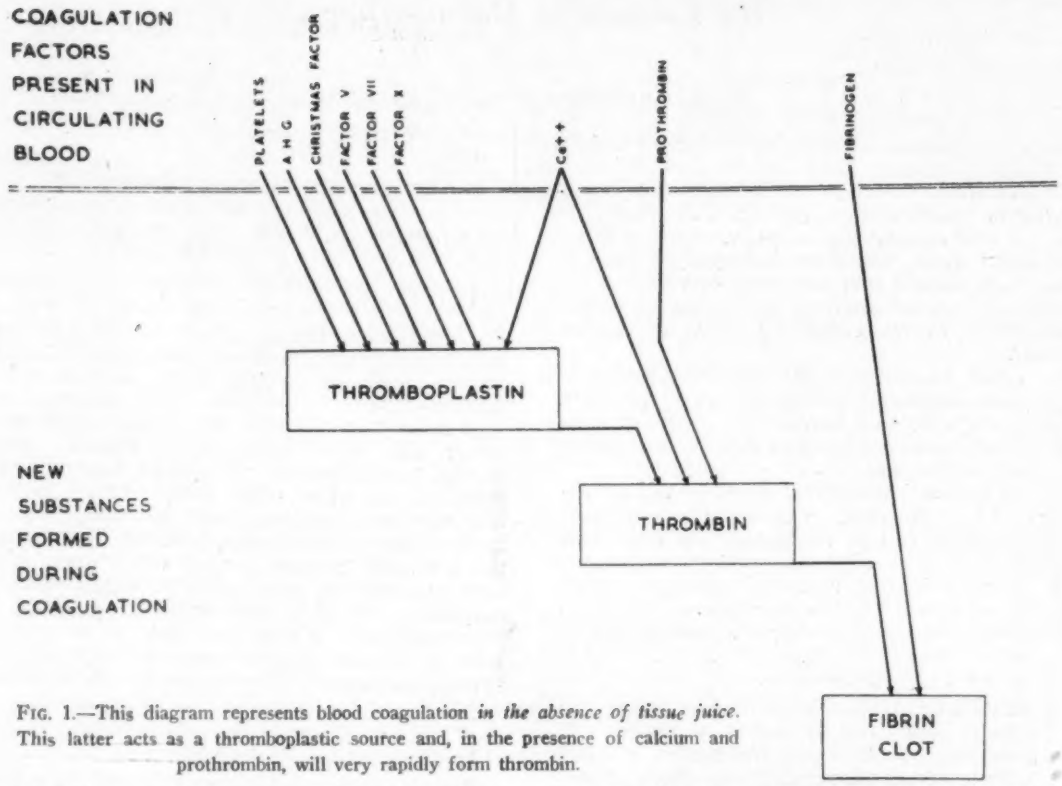

FIG. 1.—This diagram represents blood coagulation *in the absence of tissue juice*. This latter acts as a thromboplastic source and, in the presence of calcium and prothrombin, will very rapidly form thrombin.

is self evident. Tests have been devised whereby each one of the factors mentioned can be assayed separately, but it is likly that further factors, not included in Fig. 1, are in fact involved in normal coagulation.

It will be appreciated that the normal process of mammalian blood coagulation is extremely efficient, and is dependent upon a very precise balance between the circulating agents themselves. The natural coagulation of blood escaping from the vascular system is well able to cause arrest of haemorrhage in all cases where the size of the damaged vessels is such that the pressure of the escaping blood is less than the efficiency of the coagulation system can overcome. The latter is aided by such supplementary mechanical considerations as shrinkage and contraction of endothelial linings of the severed vessels, the constricting action of additional circulating adrenalin (from pain and shock) upon plain muscle fibres in the arteriole walls, and in tissue haemorrhage from the build-up of pressure from escaped blood in the intercellular spaces.

All this indicates that it is an extremely difficult problem to produce an agent which would bring about hypercoagulation without adverse effects, of such efficiency that it would reinforce the normal clotting mechanism where this is insufficient to arrest haemorrhage.

A Consideration of Agents Employed to Achieve Haemostasis

Calcium

Except in cases of hypocalcaemia (milk fever) and other similar conditions in which haemorrhage is not a feature, the normal level of circulating calcium is rarely decreased in animals, and administration of calcium does not appear to influence haemorrhage at all (Whitby & Britton, 1953; Biggs & MacFarlane, 1957). For haemostatic purposes, therefore, there is no indication for calcium therapy.

Chelating Agents

Oxalates, oxalates and malonates, and citrates have been variously recommended as drugs capable of producing hypercoagulable blood (Davies, 1939; Miller & Davies, 1939; Neuhoff & Hirschfeld, 1922; Page, Russell & Rosenthal, 1940; Stapleton, 1942). Oxalates and malonates have not proved of value in horses (Archer, 1957) and citrates have long since ceased to be employed as haemostatic drugs. It is, *a priori*, most unlikely that pharmacological products producing a *reduction* in circulating calcium could be of any value for the control of haemorrhage. Further, such agents are contra-indicated in hypocalcaemia or in conjunction with the therapeutic administration of calcium.

Vitamins

Vitamin C. The capillary endothelium may become damaged in hypovitaminosis C causing a purpuric condition (Whitby & Britton, 1953). In cases of acute blood loss, Stewart, Learmonth, and Pollock (1941) showed that intravenous administration of the vitamin was beneficial, especially if rapid restoration of the blood volume by transfusion was impossible. Ascorbic acid is thought to influence oxygen distribution within the body tissues and its administration is of some assistance in preventing damage following tissue anoxaemia. There is, however, no indication that ascorbic acid has any function which can be employed for the arrest of haemorrhages.

Vitamin P. Szent-Gyorgyi and Rusznyak (1936) found that pure vitamin C would not always prevent the haemorrhagic diathesis associated with experimental scurvy. Vitamin P occurs in nature, along with vitamin C and is capable of preventing small, petechial haemorrhages which do not respond to vitamin C. Scarborough (1940) found that vitamin P would increase capillary resistance in scurvy although Lazarus, Munro, and Bell (1948) were unable to confirm this. Vitamin P has certainly not been extensively used in therapeutics and there appears to be considerable confusion as to its chemical identity (Levitan, 1949; Clark & MacKay, 1950). There would appear to be little indication for therapy with vitamin P except in scorbutic cases.

Vitamin K. Hypoprothrombinaemia may occur in obstructive jaundice, owing to faulty absorption of the fat-soluble vitamin K from the bowel, in steatorrhoea, and in cases of prolonged diarrhoea. Such cases often have a haemorrhagic diathesis which responds to vitamin K. Therapy with this vitamin or with the water-soluble vitamin K analogue* is indicated when surgery is carried out in cases of obstructive jaundice and in conditions where bleeding occurs in association with disorders of fat metabolism.

The water miscible synthetic vitamin K_1† is very much more effective than vitamin K analogue for the treatment of excessive dosing with dicoumarol-like compounds. This vitamin is probably the most effective antidote at present available against poisoning with "Warfarin," and should be administered intravenously in large doses in such cases (*ca.* 5 to 10 mg. for small animals; 10 to 20 mg. for man; 20 to 50 mg. or more for large animals).

Adrenalin

The local vasoconstrictor effect of adrenalin has been extensively used to assist in the control of haemorrhage. However, a reactionary vasodilatation may occur which may produce further haemorrhage at a later time (MacFarlane, 1941). The monosemicarbazone of adrenochrome (an oxidation product of adrenalin) has been claimed by Roskam (1954) to have a coagulant effect, but only if injected prior to the onset of haemorrhage. A delay of about an hour occurs after injection of the drug before any effect is apparent.

Protein Precipitants

Very extensive use is made of protein precipitants to control haemorrhage in veterinary practice, but these are not easy to justify in the light of modern knowledge. Searing with the hot iron, tar, ferric chloride, copper sulphate, and even concentrated acids and alkalis have been used, but are all open to the fundamental objection that they produce a more or less impervious layer of dead tissue which, while it will usually produce temporary haemostasis, is always followed by some degree of sloughing with a great risk of consequent secondary infection and delayed healing. The slough may be extensive and secondary haemorrhage may occur when it is removed.

It is important to distinguish tissue destruction by protein precipitants on the one hand from the tissue damage which results from the use of crushing instruments, such as artery forceps, clamps, or the ecraseur, on the other hand. The latter are not open to objection on haematological grounds; tissue juice (liberated during the crushing action of these instruments) is a most potent and efficient clotting instigator and its action at a potential bleeding site is beneficial.

The Anti-heparins

After therapy with heparin, haemorrhage can be controlled by intravenous injection of protamine sulphate or of toluidine blue. Various commercial preparations of these agents are available (Cromley, 1955), but there is no controlled experimental evidence to show that any effect is produced in the normal intact animal. However, rises in blood heparin have been recorded in cases of anaphylactic shock and a heparin-like substance in the blood may cause haemorrhage after excessive doses of ionising radiation (Allen, Sanderson, Milhan, Kirschen & Jacobson, 1948; Jaques & Waters, 1941). Both of these conditions respond to toluidine blue treatment.

Tissue Extracts

Extracts of brain, horse serum, blood platelets and various other tissues, preparations of gelatin, and cephalin have all been used to hasten the coagulation of blood. Sources of thromboplastin, such as brain extracts, should indeed have an effect, but are of such low potency as to be valueless *in vivo*, especially when inevitable dilution of the coagulant in the blood is born in mind. Similarly, blood clotting is more rapid in the presence of cephalin but this could not be of any practical importance in the field, because relatively large amounts are required to produce quite a small decrease in clotting time.

Venoms

Various venoms, which have a thromboplastin-like action, have been extensively used in achieving haemostasis. The best known is Russell's viper

* "Synkavit," Roche.
† "Konakion," Roche.

venom* which has a remarkably potent thromboplastic activity even in extreme dilution. Clearly, it cannot be administered by hypodermic injection since intra-vascular clotting would occur. But it can conveniently be applied in solution to a bleeding site where it produces rapid and firm coagulation. It is best when applied on one of the absorbable sponges. Thromboplastin combines with prothrombin to form thrombin and it therefore follows that viper venom will be of much reduced efficiency, or even of no effect, in cases of hypoprothrombinaemia.

Thrombin

Commercial preparations of thrombin, usually of bovine origin, are readily available.† These preparations act upon the fibrinogen of circulating blood to produce a fibrin clot. They represent the most convenient and effective means at present available of controlling capillary haemorrhage, especially when applied upon an absorbable sponge with suitable moderate pressure. A firm, adherent clot is produced in 10 to 20 seconds and, as this clot is an entirely "natural" product, it does not act in any way as an irritant foreign body.

Absorbable Dressings

There are available numerous types of absorbable sponge intended as haemostatic dressings. In neurosurgical techniques the use of a fibrin foam and thrombin has been reviewed by Bailey and Ingraham (1944). Fibrin foam is usually prepared from bovine blood and is potentially antigenic. However, it has been shown that heat sterilisation of fibrin foam leads to a loss of antigenicity (Glynn & Richards, 1946).

Synthetic sponges have been made from gelatin (Jenkins & Clarke, 1945), calcium alginate (Blaine, 1946), and oxidised cellulose gauze (Yackel & Kenyon, 1942). These products are non-antigenic and may be impregnated not only with thrombin, in order to promote the rapid formation of a clot, but also with antibiotics to control intercurrent infection. Both oxidised cellulose and gelatin sponge have been implanted experimentally in horses without any appreciable tissue reaction (Archer, unpublished data). This is especially noticeable in the case of gelatin sponge‡ which persists for at least a week in the subcutaneous tissues with no more reaction than a small cuffing of the implant with polymorphs. After about 60 hours it becomes so friable that it can be removed, if needed, by very gentle swabbing. If infection should take place, or if there is gross inflammation, this gelatin sponge implant may be lysed within about 24 hours.

Blood Transfusion

The use of blood transfusions in animals, specifically to assist in haemostasis, has a limited application because of the extreme difficulty of obtaining compatible donor blood in the field. However, when facilities allow, restoration of the blood volume by transfusion of whole blood should always be used in cases of acute or chronic haemorrhage with appreciable blood loss. In the larger animals (horse, cow) it is probably the case that *one single transfusion* can be made without recourse to laboratory techniques for compatibility; the donor may be chosen from any available healthy member of the same species. On occasion, this may indeed be a life-saving measure, but on no account should a second transfusion be made from the same donor to the recipient without laboratory tests since an immune response to the first dose of blood may have been set up.

Polymerised polysaccharides (dextrans) are composed of glucose units and are useful, in the absence of compatible whole blood, to restore circulating blood volume. However, it must be remembered that only the plasma volume is expanded, with consequent dilution of the normal red and white cells and of the various components of plasma, proteins, minerals, sugars, etc. Injections of saline or glucose saline are of little value in the therapy of haemorrhage, the blood-volume-expanding effect being of very short duration. Such injections are best limited to use in cases requiring replacement of chloride after, for example, continued emesis.

Haematological Principles of Local Haemostasis

In order to satisfy the haematologist, haemostasis must be achieved without the production of necrotic tissue, it must involve non-irritant reagents, and it must be physiologically permanent. "It is useless to produce a clot on the surface of a bleeding wound if haemorrhage continues beneath it" (Biggs & MacFarlane, 1957). It can be assumed, in domesticated animals, that specific coagulation defects are so rare as to be unimportant. Clotting of normal blood, therefore, has to be considered.

Consideration of the surgical treatment of haemorrhage is inappropriate in this context, but it cannot be too strongly emphasised that surgical interference must always be the main line of treatment. Indeed, if any vessels of arteriole or venule size or larger are involved then surgical haemostasis by mechanical means is the only practical method of treatment available. Local contraction of these vessels when they are damaged assists in the formation of a coagulum, and the roughened or ruptured vascular endothelium constitutes a foreign surface which triggers off blood thromboplastin formation, while tissue damage yields tissue juice factor or thromboplastin additionally. Any assistance to clotting provided by the veterinary surgeon must aim at producing a coagulum firmly adherent to the bleeding tissue and extending into the orifice of any severed bleeding vessels too small to ligature.

Dressings consisting of cotton wool, or of any finely divided material, applied with suitable pressures, will provide a large area of foreign surface which is relatively non-irritant and upon which blood will clot. However, sooner or later such dressings

* "Stypven," Burroughs Wellcome & Co.

† "Thrombin Topical," Parke, Davis & Co.: "Thrombin," Maw.

‡ "Gelfoam," Upjohn.

have to be removed with consequent risk that the haemorrhage may recur. One of the newer absorbable sponge dressings is infinitely to be preferred, and especially is this so if a cavity is to be packed after surgical interference.

It is highly desirable that a thrombic or thromboplastic source be applied to a bleeding surface upon such a sponge if the sponge alone does not rapidly produce a good coagulum. The thromboplastic source provided by Russell's viper venom is remarkably potent even in extreme dilution and is an invaluable agent. However, in an animal with prothrombin deficiency (*e.g.* in jaundice, steatorrhoea, dicoumarol therapy or poisoning) a source of thrombin is indicated. It is worth recalling that only fibrinogen is required along with thrombin to form a fibrin clot. "Thrombin Topical" can conveniently be absorbed to one of the absorbable sponges and it very rapidly forms a firm coagulum.

The incorporation of an antibiotic in such haemostatic dressings is a wise precaution. In any case, an antibiotic "umbrella" is very desirable because any infection of the coagulum is likely to lead to rapid fibrinolysis (often within 24 hours) and subsequent renewal of haemorrhage. Should this occur, surgical debridement and redressing will be needed to re-establish haemostasis.

Discussion

"It is only when some specific defect of the clotting mechanism can be corrected that an effective reduction of the clotting time can be produced by general means" (Biggs & MacFarlane, 1957). Few such naturally occurring defects have yet been disclosed in domesticated animals. True haemophilia (Haemophilia A; a deficiency of antihaemophilic globulin) has been reported only in dogs; in this species the condition is exceedingly rare although it follows the same genetic pattern as does the disease in man (Hutt, Rickard & Field, 1948; Graham, Buckwalter, Hartley & Brinkhous, 1949). The condition is inherited as a sex-linked recessive, transmitted to affected males by their dams, although the dams do not show any haemostatic abnormality. So-called haemophilia B ("Christmas Disease"), which is caused by a deficiency of Christmas factor, has not been reported in animals. A haemophilia-like disease of pigs was reported by Hagan, Muhrer & Bogart (1941), but the condition was not associated with a deficiency of antihaemophilic globulin.

In 1924, Schofield reported a haemorrhagic disease occurring in Canadian cattle, the cause of which he had traced to the consumption of spoiled sweet clover hay (*Melilotus alba* and *M. officinalis*). Campbell and Link (1941) succeeded in isolating the anticoagulant substance from this clover and it was synthesised by Stahmann, Huebner and Link (1941). This substance, dicoumarol, produces its haemorrhagic effect mainly by decreasing the Factor VII content of the blood, and upon this drug and its pharmacological analogues rests the basis of anticoagulant therapy in man for the treatment of thrombosis. Warfarin is a dicoumarol-like agent and, in cases of poisoning, vitamin K_1 is a valuable treatment.

The blood coagulation system, as revealed by the newer techniques, is most complex and it requires only a "trigger" mechanism to start the formation of thromboplastin and so set the whole process in motion. There are probably two ways in which this "trigger" can start coagulation; by the formation of blood thromboplastin or by bringing in the so-called "tissue factor." The latter is capable of generating thrombin in the presence of calcium and prothrombin and is set in motion upon the breakdown of tissue cells, for example, after traumatic injury. However, as is well known, freshly drawn blood will coagulate in glass where tissue juice is not present. In this case, thromboplastin is generated within the blood from an interaction between blood platelets and certain circulating coagulation factors, probably mainly the Christmas factor. It is worth noting that both these thromboplastic processes are set in motion by contact with a foreign surface (that is, a surface other than vascular endothelium), but that blood thromboplastin is much more slowly formed than in the tissue juice process. The former may take 2 to 5 minutes in man, while the latter requires only about 10 seconds. The formation of thrombin, in either case, only requires about 3 seconds and the fibrinogen to fibrin reaction about a further 3 seconds (Biggs & MacFarlane, 1957). It is, therefore, apparent that blood will clot in the presence of tissue juice or extract far more rapidly than it will when *in vitro* in glass. Further, if the glass is siliconed, clotting is much delayed either because the silicone provides some inhibitor of thromboplastin formation or, more probably, because platelet metamorphosis is slowed down since platelets have much reduced adhesiveness to siliconed surfaces and change in platelet morphology is an essential prerequisite for the formation of blood thromboplastin.

It is important to appreciate the existence of natural inhibitors of all stages of the coagulation system. Thus, fibrinolysins are of common knowledge; antithrombin occurs in normal plasma as do very small amounts of heparin which is also an antithrombic agent; and an antithromboplastin in blood has been demonstrated by Tocantins (1942, 1943a, b). The concept of balance, which is almost the rule in physiological process, is thus given *par excellence* by the normal blood coagulation system. The introduction of an agent which destroys this balance may render the blood incoagulable (for example, a chelating agent will remove Ca^{++}) or provoke spontaneous, and random, intravascular thrombosis (trypsin given intravenously will cause extensive intravascular coagulation).

It must be emphasised that surgical techniques, which are of the very greatest importance in achieving haemostasis, have been excluded from consideration in this context.

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R.C.V.S. CORRESPONDENCE

We are informed that the Librarian to the Royal College recently received an empty envelope posted on April 15th somewhere in Aberdeenshire. It is a 4″ × 9″ manila envelope, has a 3d. stamp on it, but has never been sealed down. Will anyone who has written to the Librarian from Scotland and not had a reply please write again?

Observations on the Control of Vaginal Prolapse in a Flock of Breeding Ewes

BY

BRUCE V. JONES

Allen and Hanburys Limited, London

SUMMARY.—The use of ovine prolapse retainers in the control of vaginal prolapse in a flock of ewes is described. This method of retention was completely effective in 16 out of the 18 cases treated. While both sizes of retainer were effective the ewes in this flock were able to lamb unaided using the smaller of the two sizes available. More widespread use of this retainer would appear to be justified as it would appear to be preferable to suturing methods.

IT has been observed that vaginal prolapse is most frequently seen in the ewe, most commonly occurring in the later stages of pregnancy although also being seen *post partum* as well. In Great Britain the average incidence of vaginal prolapse in sheep has been given as 0.53 per cent. (a range of 0.2 to 3 per cent.), rising to 20 per cent. in some outbreaks (Edgar, 1952). The cause is not known but it has been postulated that an hereditary factor may be involved, possibly as an endocrine imbalance or an anatomical weakness. The mortality rate is high and up to about 50 per cent. of affected ewes may die, the condition reaching serious economic proportions in certain flocks.

Treatment consists of the reduction of the prolapse and the maintenance of the tissues in position by the use of a method or appliance to obtain retention. Such methods have included the tying of the wool, or string attached to the wool, across the vulva, or by the use of metal or tape vulva sutures, prolapse clams, and the use of leather and canvas harnesses. All these methods possess the disadvantage of merely retaining the tissues inside the vulval lips and not in holding them in an anatomically correct position. Recently a new method of retention has been described by Fowler and Evans (1957) and Fowler (1957). This method entails the use of a stainless steel wire retainer in the shape of an elongated letter U with the upright arms bent out at right-angles with eyelets at the ends. After reduction this retainer is placed in the vagina, thus holding the tissues in position and the eyelets are fastened to the wool lateral to the vulva or with string to the wool over the hip region.

Fowler and Evans (1957) reported that this method of retention merited further trial and it was decided therefore to use this retainer in a flock of 340 breeding ewes with a history, in previous lambing seasons, of vaginal prolapse. In the lambing season (1955-6) prior to this investigation, out of the total of 350 pregnant ewes, 17 (4.8 per cent. of the flock) had been affected with prolapse. All the cases had been treated by suturing or wool tying, 8 cases had held, but 9 broke down and had to be slaughtered.

Clinical Observations and Results

A flock of 340 Suffolk, Border Leicester × Cheviot ewes was observed during the lambing season commencing in March, 1957. During the season a total

of 18 cases of vaginal prolapse were observed (5.3 per cent. of flock). The retainers were used for the treatment of all cases. In 16 of the ewes the prolapse was completely controlled by the retainer, but in 2 cases where the prolapse was very severe the lips of the vulva were also sutured; however, these repeatedly broke down and the ewes had to be slaughtered.

In using this technique the prolapse was first reduced and the retainer inserted into the vagina, the eyelets being fastened with strong twine tied to the wool over the hip regions. In the affected ewes there did not appear to be any interference with natural functions and they did not seem to be conscious of the retainer. In one particularly bad case of prolapse the ewe was carrying triplets and, in spite of great intra-vaginal pressure, the retainer held the structures in place until parturition. The retainers were used in all cases that occurred and were inserted at periods up to a maximum of 4 weeks before, and not removed until, parturition.

Both sizes of retainer* were used and retention of the prolapse was equally satisfactory in all of the 16 cases. The "arms" of the retainer were not tied together because it was found that if the ewe lambed without supervision the lamb then became entangled in the retainer. The fact that the vulval lips were separated during the period of treatment did not cause any obvious effect. It was found in these ewes that the smaller retainer was more satisfactory at lambing because the oncoming lamb pushed it out easily and never became entangled. The larger retainer was not so easily ejected and the lambs were more inclined to become caught, and require assistance. Although the larger retainer would appear to give better support it also means that assistance has to be available at the time of parturition.

It is interesting to note that on this farm two flocks of sheep were kept, the one flock of 340 ewes described above which lambed in March and a smaller group of 60 Border Leicester × Cheviot ewes which lambed in January. In this smaller group no cases of prolapse were observed although the conditions of husbandry were similar. In one respect the management differed because the larger group received fairly liberal quantities of kale towards the end of pregnancy. It was observed that this produced a certain amount of "bloating" and it is possible that this increased intra-abdominal pressure may have contributed to the production of prolapse. Such a factor though would presumably only produce its effect on structures already affected by an endocrine imbalance or in ewes with an anatomical defect.

Acknowledgments.—I am indebted to the Directors of Messrs. Allen and Hanburys Limited for permission to publish these observations.

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* Ovine Prolapse Retainers, manufactured by Allen & Hanburys Ltd. Figure numbers 58409 (small) and 58410 (large). Small size 6 inches long and 1 inch wide, large size 7 inches long and 1¾ inches wide.

Inauguration of a New Pharmaceutical Plant

A new pharmaceutical plant, built at Gosport, Hants, by Cyanamid of Great Britain Ltd., at a cost of £700,000, was officially inaugurated on April 15th by Sir Alexander Todd, F.R.S., Professor of Organic Chemistry in the University of Cambridge. The inaugural ceremony took the form of a luncheon, which was attended by a number of eminent members of the veterinary profession, medical and other research workers, industrial scientists, and representatives of the agricultural industry, followed by conducted tours round the new premises. In all, some 250 guests accepted invitations, including official representatives of the B.V.A. and of the Royal College, Professor W. I. B. Beveridge, Professor L. P. Pugh, Dr. W. R. Wooldridge, Mr. H. E. Harbour, and a number of others.

The new buildings, which were designed to be appropriate to their partly rural setting, were much admired, and seemed, in addition to their architectural quality to be excellently arranged on grounds of manufacturing efficiency, convenience, and comfort of staff.

In welcoming the guests, Mr. O. N. Williams, managing director, referred to the scope of his company's activities, to the research work carried out by its scientific staff, and took occasion to announce a new product, known as Ledercort, for the treatment of rheumatism and certain other conditions. He then introduced Sir Alexander Todd, recalling that he had been awarded the Nobel Prize for chemistry last year.

In the course of his address Sir Alexander said:—

"It is only during this century that nations in general have come to realise that industrial progress rests primarily on the application of the results of scientific research. Particularly in a country such as ours, our whole economic future, and with it our standard of living, depends on it.

"The chemical industry has a striking record in recent years. Capital investment in the industry has been, and continues to be, at a very high level, and its productivity as measured by index of output has doubled in the past ten years. It is surely no coincidence that the industry has also one of the highest rates of expenditure on research and development. The expenditure varies naturally in the various branches, but in the pharmaceutical sector with which we are concerned here to-day, it is frequently as high as 10 per cent. of turnover. This is a very high rate indeed and although research is the life-blood of the pharmaceutical industry, I doubt whether it is generally realised how costly it is, and what a very large expenditure in money and scientific work lies behind every product that comes on the market.

"Our debt to the industry for this expenditure is very great. It is difficult nowadays to believe that prior to the introduction of the sulpha drugs through the work of Domagk and his colleagues of the Elberfeld laboratories of the I.G. Farbenindustrie in the middle thirties, medical men, when faced with infectious disease, could do no more than seek to alleviate

(*Concluded at foot of col.* 1 *overleaf*)

XUM

News and Comment

ROYAL COLLEGE OF VETERINARY SURGEONS DAY

Wednesday, June 11th

Following a Corporate Service and Commemoration of Benefactors to be held at the Queen's Chapel of the Savoy in the morning, there will be a luncheon at the Savoy Hotel, followed by the annual general meeting at the Royal College.

The principal speakers at the luncheon will be the Secretary of State for the Home Department and Lord Privy Seal, the Rt. Hon. R. A. Butler, C.H., M.P., and Sir James Turner, President of the National Farmers' Union.

The Service, with the choir of the Queen's Chapel, will be taken by the Chaplain, the Reverend Cyril L. Cresswell, C.V.O., M.A., F.S.A., assisted by the Reverend G. A. Willis, B.V.SC., M.R.C.V.S.

As accommodation will be limited at all the functions, early application is advised, to the Registrar at 9 Red Lion Square, who would be glad to provide all particulars. The price of three guineas per person for the luncheon is fully inclusive of cocktails, wine, or other drink, liqueurs, coffee, cigarettes and gratuities.

During the day there will be in the College an exhibition of photographs of the University of Cambridge expedition to Tibesti in the Sahara Desert, organised by two members of the profession, Mr. A. R. Akester and Mr. I. A. Silver, who received a grant from the College out of the Sir Frederick Smith and Miss Aleen Cust Research Fellowships Fund. Two films of the expedition's work have already been shown on television.

Opening of the New Lederle Laboratories—*Concluded.*

symptoms and hope that the disease would cure itself; they could not attempt to *cure* the disease. What a difference to-day! Chemical science and the pharmaceutical industry resting on it has produced not only a wide range of sulpha drugs, but antibiotics like penicillin, streptomycin, aureomycin, drugs to cure malaria, sleeping sickness, and so on and is even now marching forward in the treatment of many of the organic diseases (as opposed to those caused by parasitic organisms of one kind or another) with which mankind is afflicted.

"The opening of the Gosport laboratories marks yet another milestone in the progress of pharmaceutical industry in this country. The Cyanamid Company of Great Britain is associated with the American Cyanamid Corporation, whose Lederle Division has long been in the forefront of pharmaceutical research and development. Among its triumphs one thinks specially of its contributions to vitamin and virus research, of its synthetic drugs for infectious diseases, and its well-known antibiotic aureomycin which has also found a prominent place in the development of animal feeding—a field in which Lederle scientists have been well to the fore."

XVIth INTERNATIONAL VETERINARY CONGRESS

The Registrar of the Royal College, Mr. W. G. R. Oates, as Secretary of the British National Committee for International Veterinary Congresses, was informed on Monday that the next International Veterinary Congress will be held in Madrid from May 21st to the 27th, 1959.

BLUE TONGUE AND CATTLE EXPORTS

Australia's decision to ban imports of cattle and sheep because of the danger of introducing "blue tongue" has led to action by the Hereford Herd Book Society. At a meeting of the society's council a resolution was passed to go to the Ministry of Agriculture, all breed societies, the Royal Agricultural Society of England, and the Livestock Export Group.

The resolution recommends that the highest veterinary authorities in Australia and the United Kingdom should decide what foreign quarantine conditions would be necessary so that all British cattle could be guaranteed free from and incapable of carrying the disease. Emphasising that "blue tongue" was unknown in the United Kingdom, the resolution added: "This whole subject should be treated as a matter of great urgency."

Mr. Berry Reynolds, a leading Australian breeder and judge, who was present at the meeting, told the Society that until Australia could be guaranteed protection against the disease the ban would not be lifted. Many Australian cattle breeders regretted this as much as breeders in England because many of them depended on regular importations of British blood into their herds.

SEXTUPLET LAMBS

Sextuplet lambs born during last week-end at Preston Hill Farm, Penkridge, North Staffs, are believed to have established a record for the county. All are doing well, although the four smallest were kept for most of the week-end under an infra-red lamp and were cared for by the farmer's wife. The ewe is a four-year-old Clun bred on the farm.

THE GENTLE ART OF INVECTIVE

Occasionally, under the heading "Fifty Years Ago," extracts of past speeches, leading articles, or letters are quoted which illustrate the robust language of an earlier age as compared with the discreet meiosis of our own. We are indebted to Mr. J. R. Frean of the College of Agriculture, Potchesfstroom, Transvaal, for the following gem, which he added to a scrap-book during his student days and has preserved ever since—and no wonder. The text is that of a letter published in a veterinary periodical, and is dated from Glasgow, October 8th, 1835:—

"After all the abuse this ignorant clodpole has been able to lavish upon me, he can point out only these three errors (in the author's account of the

Edinburgh School)—that regarding the attendance of old pupils, that regarding the attendance of London-taught veterinarians, and that regarding the weekly number of Mr. Dick's lectures. All the remainder of his paper, which extends to nearly eight octavo pages, is composed of irrational reasoning, beggarly abuse, mountebank egotism, and the outrageous indecencies of one accustomed to the lowest of society; all is as feeble and vile as the source from which it proceeds. They that would know the extent of his reasoning powers, may consult the first two sentences of his twentieth paragraph, the whole of the twelfth and the twenty-fourth, or indeed, almost any other. His insignificance, his infelicity of expression, the meanness of his language, the poverty of his mind, the rankness of his egotism, his pitiful and obscure insinuations, his flatulent exultation and currish allusions, pervade every page, and faithfully describe the nature of the man. The satirical efforts of this infamous reviler are sufficiently wretched; and his apology for blacksmith quacks quite characteristic. I well know the class to which he belongs; and I heartily despise the whole race of such fangless reptiles. I also know the ultimate gain Mr. Wilson expects from his paper; and, looking at the reason I have, I cannot but consider that he who uses such means, for such ends, must be a grovelling wretch; one who for a very small gain can sacrifice honour. honesty and truth. A most sorry pick-thank.

"If the pure love of truth excite your indignation, Mr. Wilson—which is not at all unlikely—never disgrace her sacred form by the exercise of baseness for her vindication. And if mental constitution or mere necessity, renders villainy, slander, or sycophancy unavoidable, I beseech you, by your own sordid selfishness, to exhibit your odious motives in less revolting nakedness. Look at that which you have written in last month's *Veterinarian,* and compare it with that written by Mr. Youatt, in the March number; and then, at least, pretend that you blush for shame. Get Professor Dick, or some other respectable authority, to apologise to the editors for your folly, your infamy, and your insane audacity. Write nothing to me: for many years to come I can easily guess all you would like to say, whether good or bad; but I profess not to cure such cattle as you.

"You have been a most injudicious friend to Professor Dick. It is your duty, though not perhaps in your power, to relieve him from the awkward predicament in which you have placed him. He has bitterer enemies than I am, who will not scruple to say that it is a pity that he waited twelve months for a champion, and found no better than a fool . . .

"To conclude, if any respectable person will be good enough to inform me, publicly or privately, of the errors I have committed in the 'Concise Account,' I shall do what I can to rectify them; but, except upon compulsion, I shall not soil a page in that pamphlet by such a name as Wilson's. Let him, if he pleases, think me merciful if I should again address him. 'There will no learning die that day he is hanged.'—Farewell, 'thou disease of a friend.'

"JOHN STEWART."

FOOT-AND-MOUTH DISEASE

Restrictions on the movement and marketing of livestock in the infected area around Woodnesborough, Sandwich, Kent, have been withdrawn as from April 21st.

The outbreak in this area involved the slaughter of 23 cattle, 45 sheep, and 195 pigs.

THE REGISTER OF VETERINARY SURGEONS

The name of Mr. Dhiroobhai Khandubhai Desai, D.V.M. (TORONTO), c/o P.O. Box 293, Dept. of Animal Production, Khartoum, Sudan, was entered on the Commonwealth List of the Register of Veterinary Surgeons on April 14th, 1958.

The name of Aaron Vogelnest, B.V.SC. (PRETORIA), c/o South Africa House, Strand, London, S.W.1, was entered on the Commonwealth List of the Register of Veterinary Surgeons on April 17th, 1958.

THE COLONIAL VETERINARY SERVICE

Promotions

J. R. Brewster, Veterinary Research Officer, Federation of Nigeria, becomes Principal Veterinary Officer, Southern Cameroons, Federation of Nigeria; J. Prydie, Veterinary Officer, Scale "A," Kenya, becomes Veterinary Research Officer, Scale "A," Kenya; S. L. H. Walshe, Principal Veterinary Officer, Gambia, becomes Assistant Director of Veterinary Services, Uganda.

New Appointments

A. A. Forsyth, M.R.C.V.S., D.V.S.M., Veterinary Education Officer, Federation of Nigeria; I. G. Gibson, M.R.C.V.S., B.A., VET.M.B., Veterinary Officer, Kenya; and J. P. Cavill, Veterinary Officer, Trinidad.

PERSONAL

Births

BOYD.—On April 11th, 1958, at Dartington, Totnes, Devon, to Renate, wife of Hugh Boyd, DR.MED.VET., M.R.C.V.S., a second son, Peter Alexander.

BROOK.—To Jeanne (*née* Biggers) and Alan Brook, M's.R.C.V.S., of Chichester, a son, brother for Timothy and Simon.

GRAINGER.—On April 14th, 1958, to Dorothy, wife of K. J. Grainger, M.R.C.V.S., of Fairfield House, New Town, Uckfield, Sussex, a son, Robin John.

LLEWELLYN.—On April 17th, 1958, at Cardiff Maternity Hospital, to Pauline, wife of David G. Llewellyn, B.V.SC., M.R.C.V.S., a son, brother for John.

STEPHENS.—On April 12th, 1958, to Jane, wife of Meyrick Stephens, B.SC., M.R.C.V.S., of 38, High Street, Theale, Berkshire, a daughter, Harriet Jane.

Marriage

WILLIS—WICKENS.—At St. Margaret's Methodist Church, Luton, Bedfordshire, on March 29th, 1958, John Willis, B.SC., to Gillian O. Wickens, B.V.M.S., M.R.C.V.S.

R.C.V.S. OBITUARY

Supplementary Veterinary Register

MACKAY, Alfred Andrew, 45, Castle Street, Reading, Berks. Died April 13th, 1958.

XUM

COMING EVENTS

April

30th (Wed.). First Meeting of the B.S.A.V.A. Eastern Region No. 3 at the "University Arms" Hotel, Cambridge, 7 p.m.

Meeting of the Veterinary Hygiene Section at the Royal Society of Health Congress in the Winter Garden Pavilion, Eastbourne, 2.30 p.m.

May

1st (Thurs.). Annual General Meeting of the Central Veterinary Society at the Royal Veterinary College, Camden Town, N.W.1, 6 p.m.

7th (Wed.). First Annual General Meeting of the B.S.A.V.A. Midland Region at the Queen's Hotel, Birmingham, 2 p.m.

8th (Thurs.). General Meeting of the Lancashire Veterinary Association in Room 48, Victoria Building, University of Liverpool, 2.30 p.m.

9th (Fri.). Meeting of the R.A.V.C. Division at the R.A.V.C. School and Stores, Thornhill, Aldershot, 12 noon.

10th (Sat.). Annual Dinner-Dance of the Chiron Club at the Royal Hotel, Bristol, 6.30 p.m.

Annual General Meeting of the Scottish Regional Group of the A.V.T. & R.W.'s at the University of Glasgow Veterinary Hospital, Bearsden Road, Bearsden, Glasgow, 10.45 a.m.

Meeting of the B.S.A.V.A. North West Region (No. 9) at the Queens Hotel, Piccadilly, Manchester, 8.15 p.m.

10th and 11th (Sat. and Sun.). 6th Annual Reunion of the R.V.C. '52 Club at Ye Miller of Mansfield, Goring-on-Thames.

15th (Thurs.). Annual General Meeting of the Supplementary Register Division at 7, Mansfield Street, Portland Place, London, W.1, 3 p.m.

Ordinary General Meeting of the South Eastern Veterinary Association at the Royal Star Hotel, Maidstone, 6.30 p.m.

16th (Fri.). Annual General Meeting of the Society of Practising Veterinary Surgeons in the Station Hotel, York, 2.30 p.m.

Annual Ball of the R.V.C. Students' Union at the Royal Veterinary College, London, N.W.1, 9 p.m.

ADDRESSES OF DISEASE INFECTED PREMISES

Anthrax

Ches. Peckforton Hall, Tarporley (Apr. 16).
Northants. Walnut Tree Farm, Higham Ferrers, Wellingborough (Apr. 14).

Foot-and-mouth Disease

Norfolk. Glebe Farm, Horsford, Norwich (Apr. 16); Monks Marshes, 7, Mile House Level, Reedham (Apr. 17).

Fowl Pest

Essex. High Birch Poultry Farms Ltd., Weeley Heath, Clacton-on-Sea (Apr. 12); Abrams Farm, Mount Bures, Colchester (Apr. 15).
Hants. The Oaks, Hill Coppice, Titchfield, Fareham (Apr. 15).
Herts. Basildon, Holly Lane, Bower Heath, Harpenden (Apr. 11); Crib Street, Ware (Apr. 15).
Lancs. Stanley Farm, Roseacre, Kirkham, Preston; Hillcrest, St. Michaels, Preston (Apr. 16).
Norfolk. Shouldham, King's Lynn (Apr. 11); Reynolds Farm, Great Witchingham, Norwich (Apr. 15).
Northants. 14, Middle Street, Farcet, Peterborough; 9, Field Terrace, Farcet, Peterborough; 8, Dovecote Close, Yarwell, Peterborough (Apr. 11); 19, St. Marys Close, Farcet, Peterborough; St. Marys Lane, Farcet, Peterborough; 31, Main Street, Farcet, Peterborough (Apr. 13); 29, Main Street, Farcet, Peterborough; Elmington Top Lodge, Ashton (Apr. 14); Severals Farm, Farcet, Peterborough (Apr. 16).

Swine Fever

Anglesey. Ty Newydd Piggeries, Llanynghened, Holyhead; Pencraig, Valley (Apr. 15).
Beds. White Horse Inn, Wilstead (Apr. 17).
Berks. Plot C14, Red Cow Allotments, Caversham, Reading (Apr. 15); Liddiard's Farms Ltd., East Shefford Farm, Newbury (Apr. 16).
Bucks. 62, Wymers Wood Road, Burnham (Apr. 14); Waggon and Horses Public House, Stone, Aylesbury (Apr. 15).
Derby. Border View Piggeries, Rodmoor Road, Dronfield Woodhouse, Sheffield (Apr. 15).
Devon. Highweek, Newton Abbot (Apr. 14).
Dorset. Lake Farm, Thornford, Sherborne (Apr. 14).
Essex. Debden Hall Farm, Debden, Saffron Walden (Apr. 15).
Flints. Clwyd Piggeries, Rhuddlan, Rhyl (Apr. 15).
Hants. Brookside Piggeries, Agars Lane, Hordle, Lymington (Apr. 15).
Kent. Hewitts Farm, Chelsfield, Farnborough (Apr. 16).
Lancs. Halewood House Farm, Wood Road, Halewood, Liverpool (Apr. 14); Hop Pole Farm, Mill House Lane, Croft, Warrington (Apr. 16).
Leics. Manor Farm, Brascote, Newbold Verdon (Apr. 11); Pingle House Farm, Seine Lane, Enderby (Apr. 14).
Oxford. Manor Farm, Little Clanfield (Apr. 11).
Somerset. Tyning, Courtney Road, Keynsham, Bristol (Apr. 14).
Surrey. Seale Fruit Farm, Seale, Farnham (Apr. 14).
Warwicks. Oxford Road, Long Compton, Shipston on Stour (Apr. 17).
Wilts. Fairfield Piggeries, Bradford-on-Avon (Apr. 15).
Worcs. Shakespeare Farm, Ipsley, Redditch (Apr. 15).

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN
Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period		Anthrax	Atrophic Rhinitis	Foot-and-Mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 31st March, 1958		15	1	3	22	—	56
Corresponding period in	1957	31	—	2	19	—	32
	1956	139	—	—	23	—	31
	1955	42	—	—	18	—	71
1st January to 31st March, 1958		52	2	100	195	—	268
Corresponding period in	1957	133	2	15	251	—	313
	1956	822	3	8	171	—	153
	1955	267	—	6	166	—	312

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

SCIENTIFIC

Properdin Test and Conglutinin

Sir,—It has recently been demonstrated by Pillemer and his associates that normal human and other mammalian sera contain a protein, properdin, which is one of the factors responsible for natural resistance. Properdin acts in conjunction with complement and magnesium and participates in the destruction of certain bacteria and the inactivation of certain viruses. It is likely that further studies on properdin will be made in the veterinary field, and the following note may be of interest to research workers.

The properdin test as described by Pillemer *et al.* was used in this laboratory in studies on sera from several healthy adult cattle. The results of the tests were complicated by a form of agglutination of erythrocytes during the final titration of C^3 (third component of complement) in tubes of both the test series and control series. This agglutination occurred using either human serum or guinea-pig serum as the source of R.P. (reagent for properdin), and could be only partially reduced by preliminary adsorption of the sera with sheep red cells before the test. Subsidiary studies indicated that the agglutination was in effect a conglutination reaction. Rice has recorded that certain mixtures of guinea-pig serum (even if zymosan treated) and fresh bovine serum brought about both haemolysis and conglutination of sheep red cells sensitised with rabbit antibody. In the properdin test using bovine serum, all the reagents necessary for conglutination appear to be present, namely conglutinin from the bovine serum, conglutinating complement components from the mixture of fresh bovine serum and R.P. (whether the latter is derived from guinea-pig or human serum), and sheep red cells sensitised with rabbit antibody. The sensitised red cells used in the final stage of properdin tests on bovine sera are therefore liable not only to the usual lysis, but also to conglutination.

It was also observed that flocculation occurs on the addition of zymosan to bovine sera; the flocculum sediments rapidly and is difficult to resuspend uniformly. The conglutinin titre of bovine serum, ascertained by the method of Coombs and Coombs, was shown to be markedly reduced after exposure of fresh serum to zymosan. Pillemer *et al.* reported that the eluate from bovine serum-zymosan complex exhibited properdin and conglutinin activities. These latter observations suggest that zymosan forms a complex with conglutinin when added to bovine serum and that its action is similar to that of kaolin in this respect.

The writer wishes to thank Dr. A. C. Wardlaw, Wright-Fleming Institute of Microbiology, for his interest and advice in connexion with these studies, and for provision of reagents.

Yours faithfully,
R. L. CHANDLER.

Agricultural Research Council,
Field Station,
Compton,
Nr. Newbury,
Berks.

April 21st, 1958.

References

COOMBS, A. M., & COOMBS, R. R. A. (1953). *J. Hyg.* **51**. 509.

PILLEMER, L., BLUM, L., LEPOW, I. H., ROSS, O. A., TODD, E., & WARDLAW, A. C. (1954). *Science*. **120**. 279.

RICE, C. E. (1953). *J. Immunol.* **70**. 497.

GENERAL

A Plea

Sir,—Words have two functions: on the one hand to state facts, and on the other to provoke emotions, and one of the elements in the transition from barbarism to civilisation is the increasing use of words to indicate rather than to excite. It should be a part of science and scientific philosophy to ensure and to teach the young the use of words with a precise meaning. Veterinary science is claimed as both a science and an art. The artist and the poet are traditionally allowed a full measure of "artistic" or "poetic" licence, but they must first, it seems, firmly establish their claims to be so classified.

During recent years, in scientific papers which presumably lay no great claim to poetic merit, and in letters, articles, abstracts, and annotations appearing in the current veterinary journals, members of the profession seem to be disregarding many of the accepted laws of our language, and I feel that it is time someone drew attention to these matters.

Perhaps one of the commonest examples of misusage is the employment of an adjective in place of a noun. We read that such and such happens in "the bovine" or in "the equine"; and our medical confrères are guilty of saying "the human" when they mean "the human being." If the "bovine animal," the "equine subject," or the "human being" take up too much room, why not use, as Professor McCunn suggested some months ago, the good old words, ox, horse, and man, or the even more precise terms, cow, colt, child, or whatever it may be?

Not so long ago we read that "it was decided to 'stabilise' the horse," when the author really meant that the horse was put into a loose-box, not even a stable! To me, that word is only one degree less horrible than "stabilisation," used to mean putting a horse into a stable! "Hospitalise" and "hospitalisation" are two others far beyond the pale.

"Vomition," to mean vomiting, is tending to creep into canine nomenclature. According to most reput-

able dictionaries, there is no such word as "vomition" although "vomiturition" is listed, but is "vomiting" not the correct and exact word?

When should one use "domestic," and when "domesticated"? The late Principal O. Charnock Bradley always insisted that one spoke of a domestic teacup or hearthrug, but a domesticated animal. This appeals to me as good sense, but I must be in a minority since so many colleagues speak of "domestic animals" and include the farm animals as well as dogs and cats, which could, I suppose, be described in truth as "domestic" animals. However, the word is inadequate; its meaning has changed. If we have "domesticated" the horse and ox, etc., has mankind also "domesticated" the water buffalo, the yak, or for that matter, the elephant?

Then there is the word "Thoroughbred." For some extraordinary reason a large number of people, by no means only veterinary surgeons, accept Shire, Clydesdale, Shorthorn, Blackface, Greyface, even Half-bred, and give each a capital initial letter. But they write "thoroughbred"! Surely if any breed of animal deserves a capital initial letter, it is the Thoroughbred. The reason and the logic are too obvious to merit further comment. I am glad to note that THE VETERINARY RECORD has recently printed "Thoroughbred" correctly and is a shining light in this respect even to *The Times*, still wallowing in darkness, and to the *British Racehorse*, which ought to know better.

Perhaps I have written enough to make my point, though quite a number of other instances could be given where the increasing tendency to misuse words confuses or stultifies the meaning. It is indeed salutary to read the best of the scientific language of a hundred years ago. Little to-day can measure up to its dignified fluency, clarity, and vigour. If at times it may seen flowery or baroque, these are but characteristics of the age and do not detract from understanding.

May I end with a quotation from Lord Chesterfield? "Words are the dress of thoughts; which should no more be presented in rags, tatters and dirt, than should your person."

Yours faithfully,
WM. C. MILLER.

The Animal Health Trust,
Equine Research Station,
Balaton Lodge,
Newmarket,
Suffolk.
April 17th, 1958.

"Doctor" or "Mister"

Sir,—Your issue of March 8th has just arrived here. I see that the age-old controversy on the above subject is once again in the news. Some years ago, I wrote strongly advocating the courtesy title of doctor for our members and drew down no small amount of vituperation and scorn on myself.

Here, in Jamaica, all veterinarians are accorded such a courtesy title whether they be Canadian graduates, members of the Royal College, or just plain "quacks." It has its advantages but also many disadvantages.

There is a medical practitioner whose telephone number closely approximates to mine and I am frequently receiving his calls. Only the other evening a voice said "Is that you, doctor?" and when I said "Yes" I was asked when I would be calling to see the speaker's daughter. I later heard from my friend the doctor that he was having similar experiences. Last week a voice asked "Is that you, doctor?" and when he replied "Yes" the voice said "Have you time to come round this evening and have a look at my pussy?" I make no comments!

Yours faithfully,
L. R. GEFFEN.

Kelroche,
99, Hope Road,
Liguanea P.O.,
Jamaica, B.W.I.
April 1st, 1958.

Mutation of the Bovine Foot

Sir,—I noted with interest Mr. Barnes's letter in THE RECORD of March 29th requesting information on the breeding of the bullock with single front claws that I described recently.

There was no in-breeding to my knowledge or to the owner's. He had bred the cow himself and purchased the bull from some considerable distance away.

Yours faithfully,
RICHARD H. C. PENNY.

The Black Lion Yard,
High Street,
Leighton Buzzard,
Beds.
April 16th, 1958.

A Male Tortoiseshell Cat

Sir,—For twenty years now I have thought it genetically impossible for a male tortoiseshell-coloured cat to appear. I have now found the exception to the rule in Walsall, having been called in to treat such a cat for influenza.

The markings were as follows: white all over with fawn and black patches on head, sternum, and sacral regions. I have no evidence as to whether this animal has bred. He was allowed to roam freely but no queen was brought to him.

Yours faithfully,
W. B. BROWNIE.

1, Marsh Street,
Walsall.
April 9th, 1958.

VETERINARY EDUCATION IN EAST AFRICA

It has been suggested that the first paragraph, in a letter published under the above heading last week, could convey the impression that the British Council had financed the recent journeys abroad of several eminent veterinary surgeons. We are informed, however, that in some cases grants were made not by the British Council but by the Colonial Office and the University of London.